

FUTURE TECHNOLOGY MAGAZINE

20-vii AMERICAS



LATEST

Lumileds: boost to IR LEDs' drive current lifts radiant power output

SEE PAGE 4

FEATURE
INDUSTRIAL
AUTOMATION/
INDUSTRY 4.0

FROM PAGE 14

DESIGN

Nexperia explains thermal and efficiency benefits of SiGe rectifiers

SEE PAGES 12-13

TECH VIEW

The role of ESD protection in the all-IP car

SEE PAGES 18-19

Ultra low-power MCUs give longer battery life in IoT sensor systems



Renesas has expanded its RE family of embedded controllers by adding new RE01 ultra low-power microcontrollers based on Renesas' breakthrough Silicon-On-Thin-Buried-oxide (SOTB™) process technology, and built around the Arm® Cortex®-M0+ processor core.



The new RE01 MCUs feature a Flash memory provision of 256kbytes. RE01 MCUs with 1.5Mbytes of Flash are already in mass production. Available in a WLBGA package as small as 3.16mm x 2.88mm, the new 256kbyte RE01 MCUs are intended for use in sensor control in compact IoT devices. Independent testing verifies the low-power performance of the latest RE01 MCUs. Tested according to the parameters of the EEMBC® ULPMark™-CoreProfile benchmark, the 256kbyte RE01 MCU achieved a high score of 705.

Implementation of Renesas' proprietary SOTB process technology enables marked reductions in both active and standby current: in normal operation, current is as low as 25µA/MHz, and 400nA in standby mode. Operating current can be reduced even further, to 12µA/MHz, by using Renesas' ISL9123, which draws ultra-low quiescent current, as an external step-down regulator. Despite the new MCUs' ultra-low power consumption, they are capable of high-speed operation in applications which require real-time data processing from multiple sensors, even when powered by small batteries or by energy-harvesting devices. The Cortex-M0+ core can run at a maximum operating frequency of 64MHz, and the device features an on-chip 14-bit ADC for digitizing sensor inputs at high speed and resolution. Development tools compatible with the RE01 MCUs' evaluation kit include IAR Embedded Workbench® for Arm, which supports the IAR C/C++ compiler, and e2 studio, which supports the GNU compiler. Driver software supporting Arm's Cortex Microcontroller Software Interface Standard (CMSIS) is available. Renesas also supplies low-level sample code for use in low-power applications which cannot permit the power loss caused by the operation of driver software.

Precision op amp features ultra-low input-offset voltage and low noise



Diodes Incorporated has introduced its first precision operational amplifier, the dual-channel AS2333, which offers highly stable and linear outputs.

The AS2333 uses chopper stabilization to achieve an ultra-low input-offset voltage of 8µV. Near-zero drift over time and temperature, of

just 0.02µV/°C, means that system designers can rely on the stability of sensor signals in applications requiring high precision and accuracy. The AS2333 is ideal for amplifying the small signals from sensors which measure parameters such as pressure, sound, light, temperature, voltage or current. Chopper stabilization also minimizes low-frequency 1/f noise and offset-voltage crossover distortion. The op amp also features high-impedance inputs with a common-mode range 100mV beyond the supplies. Output swing is within 50mV of the rails. Features well suited to use in battery-operated applications include a typical quiescent current of 12µA, and support for supplies as low as 1.8V ±0.9V.



AS2333: Amplifies small sensor signals with low noise and low distortion

ENERGY

INDUSTRIAL

LIGHTING

MEDICAL

TRANSPORT

SECURITY

CONSUMER

TELECOMS

APPLICATIONS

- Smart home and smart building systems
- Environmental sensing
- Structure monitoring
- Trackers
- Wearable devices

FEATURES

- 128kbytes SRAM
- Operating-voltage range: 1.62V to 3.6V
- On-chip energy-harvesting control circuit
- 0.6mA current to program on-chip Flash memory
- Trusted Secure IP security core

FTM DEVELOPMENT BOARD

Part supported:
256kbyte
R7F0E01182CFM
in a 64-pin
LQFP package.



Orderable Part Number: RTK70E0118S00000BJ
Available at FutureElectronics.com

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LDO combines low quiescent current with wide input-voltage range

ON Semiconductor®




The NCP730 from ON Semiconductor is a CMOS Low Dropout (LDO) voltage regulator which draws a very low quiescent current, helping to prolong run-times in battery-powered, always-on systems or IoT applications.

The LDO operates from a wide input-voltage range of 2.7V to 38V. There are various fixed output-voltage options. The NCP730 is also available with an adjustable output voltage in the range 1.2V to 24V. The LDO is capable of supplying a maximum 150mA continuous output current, and 200mA peak current. It includes a built-in soft-start circuit and thermal shut-down protection. The dropout voltage, rated at 290mV at 150mA and a 3.3V output, keeps conversion power loss to a minimum, while regulation is maintained at a consistently high level. Output-voltage accuracy is ±1% over an operating-temperature range of -40°C to 85°C. Parts which include a Power Good (PG) circuit indicate that output voltage is in regulation. This signal may be used for power sequencing, or as a microcontroller reset.


The NCP730 integrates an innovative fast transient-response amplifier to limit under- and over-shoot, as well as short-circuit and over-temperature protection functions.


Part Number	Voltage Option	Version	Package
NCP730ASNADJT1G	Adjustable	Without power good	TSOP-5
NCP730ASN250T1G	2.5V		
NCP730ASN280T1G	2.8V		
NCP730ASN300T1G	3.0V		
NCP730ASN330T1G	3.3V		
NCP730ASN500T1G	5.0V	With power good	2mm x 2mm WDFN6
NCP730BMTADJTBG	Adjustable		
NCP730BMT250TBG	2.5V		
NCP730BMT280TBG	2.8V		
NCP730BMT300TBG	3.0V		
NCP730BMT330TBG	3.3V		
NCP730BMT500TBG	5.0V		
NCP730BMT1500TBG	15.0V		


ENERGY


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APPLICATIONS

- Battery-powered tools
- Home automation
- Metering
- Remote controlled devices
- White goods
- Combination arc-fault circuit breakers

FEATURES

- 1µA quiescent current
- 100nA shut-down current
- Stable with small 1µF ceramic capacitors
- Power-supply ripple rejection: 80dB at 10Hz and 70dB at 10kHz

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New dual DC-DC converters provide independently isolated asymmetrical outputs




CUI Inc has introduced a family of isolated DC-DC converters which supply dual regulated outputs for rated loads up to 3W, 10W or 20W. Supplied in SIP or DIP packages, these converter modules operate from a wide input-voltage range of 18V to 75V DC.





CUI DC-DC converters: Wide 18V to 75V input range


The PRQ3W-S series supplies up to 3W of continuous power. Operating over a wide temperature range of -40°C to 85°C and supplied in a SIP package, these low-power DC-DC converters provide a rugged solution for sensitive power systems.


The PQD10W-D series supplies up to 10W of continuous power. Housed in an industry-standard 1" x 1" DIP package, the PQD10W-D modules also operate over a temperature range of -40°C to 85°C. These DC-DC converters are suitable for convection-cooled equipment and industrial power circuits. The PQF20W-D series supplies up to 20W of continuous power. Featuring an extended -40°C to 105°C operating-temperature range, these modules are housed in 2" x 1" DIP package. The PRQ3W-S, PQD10W-D and PQF20W-D all offer asymmetrical outputs. These independently isolated outputs make the converters ideal for space-constrained applications which supply two loads, such as motor-control circuits, distributed power supplies and hybrid module systems. CUI also supplies the PRF30W-D series, which provides up to 30W of continuous power.


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APPLICATIONS

- Motor-control circuits
- Distributed power supplies
- Hybrid module systems
- Medical equipment
- Telecoms and network equipment
- Remote control systems

FEATURES

- Dual output-voltage options:
 - 5V/5V
 - 5V/12V
 - 5V/24V
- 3kV DC isolation
- Protection functions:
 - Short-circuit
 - Over-current
 - Input under-voltage
- UL/EN/IEC 62368 certified

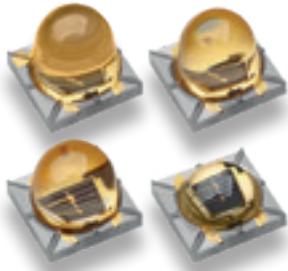
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Boost in radiant power of domed IR LEDs to improve performance of motion-tracking and surveillance cameras

LUMILEDS

Lumileds has introduced additions to its LUXEON IR Domed Line of infrared LED emitters, offering a marked increase in DC drive-current capability up to 1.5A, and pulse current up to 5.0A.



These higher drive currents produce increased maximum radiant power output of 1,350mW at the slightly visible 850nm wavelength, or 1,450mW at 940nm for invisible or covert IR emission.

The higher power capability of these new IR LEDs enables clearer 3D imaging with fewer LEDs in multi-emitter applications, such as the 3D scanning or time-of-flight systems used for face recognition.

The higher optical power output of the new LUXEON IR Domed Line of LEDs is particularly useful in the latest generation of small, high-resolution surveillance cameras, which have smaller lens apertures, and smaller pixels in the image sensor. These systems need more light to function properly.

The new LUXEON IR Domed Line parts may be used as drop-in replacements for lower-power IR LEDs in existing designs, as they have a standard 3.7mm x 3.7mm footprint.

The new LUXEON IR Domed Line emitters also now include a narrow-beam 50° LED, complementing the existing 60°, 90° and 150° emitters. The range of optical outputs provided by the LUXEON IR Domed Line gives IR camera designers the ability to optimize for high punch, long range or wide scanning.

Miniature IR emitters offer high optical power density

The LUXEON IR Compact Line is a series of high-power, efficient infrared emitters which are suitable for mounting in small spaces.

The LEDs' compact and well-defined light-source geometry allows them to be easily coupled into secondary optics for tight beam control. The package has a footprint of 1.9mm x 1.37mm and a two-pad configuration, providing high power density and supporting a new generation of miniaturized designs.

Featuring best-in-class thermal conductivity, the LUXEON IR Compact Line LEDs maintain excellent performance in real-world operating conditions.

Features:

- Available in 850nm and 940nm wavelengths
- Radiant power output:
 - 1,050mW for 850nm emitter
 - 1,150mW for 940nm emitter
- 2.8°C/W thermal resistance

Applications:

- Surveillance/CCTV cameras
- Machine vision
- 3D scanning
- Time-of-flight sensing systems
- Biometric identification
- User interface control
- Augmented and virtual reality



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IR INFRARED



- APPLICATIONS**
- Biometric identification
 - Virtual reality and augmented reality headsets
 - Machine vision
 - Surveillance cameras
 - Security and access-control equipment
 - User interface controls
- FEATURES**
- Forward voltage:
 - 3.2V for 850nm emitters
 - 2.9V for 940nm emitters
 - Full-width half-maximum spectrum
 - 35nm for 850nm emitters
 - 50nm for 940nm emitters
 - 2.5W/°C thermal resistance
 - 145°C maximum junction temperature

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Broadband IR emitter ideal for spectroscopy and hyperspectral imaging

The LUXEON IR ONYX LED module from Lumileds provides continuous broadband infrared emission over a spectral bandwidth of 650nm to 1,100nm. Offering superior light-output characteristics, the product comes in an industry-standard 2720 package and footprint for easy integration in existing designs.

The LUXEON IR ONYX, which has the orderable part number L1IG-075010000000, gives new scope to equipment manufacturers to miniaturize spectroscopy and hyperspectral imaging applications in handheld devices for mobile, industrial, and medical applications.

Features:

- Minimum radiant power output:
 - 40mW over 600nm to 1,050nm spectrum
 - >80µW/nm over 750nm to 1,000nm spectrum
- Robust, long-life phosphors
- Flat spectrum allows for ease of calibration

Applications:

- Spectroscopy
- Machine vision
- Healthcare equipment
- Hyperspectral imaging



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High-speed comparators handle wide input-voltage range

ON Semiconductor



The NCS2250 and NCS2252 from ON Semiconductor are low-voltage comparators suitable for use in complex applications that require a fast response time and flexible implementation. They may be used to implement functions such as logic-level shifting and translation, clock and data signal restoration, and the voltage-level trigger in power converters.

The NCS2250 and NCS2252 families achieve fast response for operation in high-speed sampling circuits thanks to their short propagation delay of just 50ns with 100mV overdrive.

Featuring an extended common-mode input-voltage range, the comparators handle

input signals 200mV above and below the rails, supporting voltage detection at ground or on the supply rail. The low quiescent supply current, just 150µA with a 5V supply, makes these devices suitable for use in battery-powered systems.

The NCS2250 parts provide a complementary push-pull output, and the NCS2252 parts an open drain output. The comparators are available in pin-compatible SC70-5 or SOT23-5 packages.



NCS2250: Complementary push-pull output

Part Number	Output Type	AEC-Q100 Qualified	Package
NCS2250SQ2T2G	Complementary	No	SC70-5
NCS2250SN2T1G	Complementary	No	SOT23-5
NCS2252SQ2T2G	Open drain	No	SC70-5
NCS2252SN2T1G	Open drain	No	SOT23-5
NCV2250SQ2T2G	Complementary	Yes	SC70-5
NCV2250SN2T1G	Complementary	Yes	SOT23-5



- APPLICATIONS**
- Automotive lighting
 - Industrial lighting
 - Mobile phones
 - Power supplies
 - Portable and battery-powered systems
- FEATURES**
- 88dB power-supply rejection ratio
 - 81dB common-mode rejection ratio
 - 6mV maximum input-offset voltage
 - 3.8pF input capacitance
 - Supply-voltage range: 1.8V to 5.5V
 - Operating-temperature range: -40°C to 125°C

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HIGH POWER DENSITY

MDW12/MDW112 Series · 12W · DC-DC Converter

- Industrial Standard DIP-16 Package (0.94 x 0.54 x 0.40")
- Wide 2:1 & 4:1 Input Voltage Range
- I/O Isolation 1500 VDC
- Low No Load Power Consumption

For more similar family : MD Group 6-10W

MINMAX POWER SOLUTIONS 1-150W

GENERAL INDUSTRIAL

1-150W DC-DC Converters
1-150W AC-DC Power Supplies

ULTRA-HIGH ISOLATION

1-150W DC-DC Converters

RAILWAY CERTIFIED

0-150W DC-DC Converters

MEDICAL SAFETY

0-150W DC-DC Converters
0-150W AC-DC Power Supplies

UL

CB Scheme

CE

RoHS

Development kit supports rapid prototyping with the PolarFire SoC FPGA

Microchip has introduced a development kit which provides a rich application environment for evaluation of the features of its PolarFire® SoC FPGA.



Five-core RISC-V microprocessor sub-system, innovative Linux® operating environment, real-time, low-power capabilities and its rich set of peripherals. These sophisticated features make the PolarFire SoC ideally suited to secure, reliable and power-efficient computing

The Icicle kit, which has the orderable part number MPFS-ICICLE-KIT-ES, enables evaluation of the PolarFire SoC FPGA's

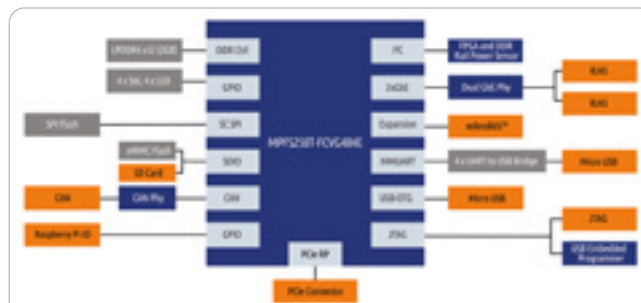
functions across a wide range of applications, including imaging and vision functions which use artificial intelligence.

The Icicle main board includes LPDDR4 DRAM, SPI Flash non-volatile memory and eMMC storage to enable the PolarFire FPGA to run the Linux operating system off-the-shelf. The kit is also supplied with a multi-rail power sensor to monitor multiple power domains. A PCIe root port and Raspberry Pi and mikroBUS expansion ports, alongside a number of wired connectivity options, support quick system prototyping using a wide choice of peripheral function boards.

options, support quick system prototyping using a wide choice of peripheral function boards.

The PolarFire SoC Icicle kit is supplied with:

- MPFS250T-FCVG484EES PolarFire SoC
- USB cable
- QuickStart card
- 12V/5A AC power adapter and cord
- Ethernet cable



Microchip's MPFS-ICICLE-KIT-ES: Multiple interfaces to expansion boards and serial data connections

PolarFire SoC: the low-power, high-security, multi-core FPGA

The PolarFire® SoC FPGA family offers a combination of low power consumption, thermal efficiency and defense-grade security for smart, connected systems. It is the first system-on-chip FPGA to feature a deterministic, coherent RISC-V CPU cluster and a deterministic L2 memory sub-system, enabling the execution of real-time functions on a Linux® operating platform.

Built on the mid-range, low-power PolarFire FPGA architecture, the PolarFire SoC devices can consume 50% less power than alternative FPGAs. They are available in versions featuring between 25,000 and 460,000 logic elements and include 12.7Gbits/s transceivers.

Security features in the PolarFire SoC FPGA include:

- Secure hardware
 - Secure wafer sort and packaging
 - Spectre- and Meltdown-immune CPUs
- Design security
 - DPA-resistant bitstream programming
 - Anti-tamper
 - DPA-resistant secure boot
- Data security
 - CRI DPA countermeasures pass-through license
 - DPA-resistant cryptography co-processor
- RISC-V Physical Memory Protection (PMP)

APPLICATIONS

- Imaging
- Artificial intelligence and machine learning
- Industrial automation
- IoT devices
- Wireline access networks
- Aerospace
- Defense equipment
- Automotive systems

FEATURES

- Secure boot
- 4 x 12.7Gbits/s SERDES interfaces
- PCIe interface
- USB 2.0 interface
- UART/SPI/I²C interface
- CAN interface
- Power sensor

FTM DEVELOPMENT BOARD



Orderable Part Number:
MPFS-ICICLE-KIT-ES

Available at FutureElectronics.com

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Directly from 48V,
24V or 12V bus to
point-of-load regulators
for industrial automation
applications



Wide operating range



Simple to use; fast development time



High efficiency



Flexible and rich
feature set



PI33xx, PI34xx, PI35xx



PI358x GQFN

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VICOR

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Buck-boost DC-DC converter features ultra-low quiescent current for use in wireless devices



Renesas has introduced the ISL9122, a family of flexible buck-boost switching regulators which draws ultra-low quiescent current. This makes them ideal for use in powering sensors, microcontrollers, wireless devices and other system components which normally operate intermittently, with long periods in standby mode.



ISL9122: Dynamic voltage scaling adapts power usage to application conditions

Quiescent current is rated at <1.3µA. In shut-down mode, the ISL9122 draws just 7nA. Operating over an input-voltage range of 1.8V to 5.5V, the ISL9122 is suitable for use in systems powered by coin cells, lithium-ion rechargeable batteries or multiple alkaline primary batteries in series.

The ISL9122 regulator implements dynamic voltage scaling in I²C-programmable 25mV steps to optimize system power consumption.

In addition, its ability to boost output power up to 5.375V maximizes the RF transmission capabilities of IoT devices across their battery range.

Switching frequency control is implemented by either pulse-frequency or Pulse-Width Modulation (PWM), depending on the load. In forced PWM mode, the regulator always switches at 2.5MHz, which improves the system's EMI performance.

Like the ISL9123 buck regulator, the new ISL9122 is ideal for powering the Renesas RL78 family of 8-/16-bit ultra low-energy MCUs, the RA family of 32-bit MCUs with Arm® Cortex®-M cores, or the RE family of embedded controllers for wearable devices and energy-harvesting applications.

FTM DEVELOPMENT BOARD

Orderable Part Number: ISL9122AIIN-EVZ

Available at FutureElectronics.com



- APPLICATIONS
- Wireless earbuds
 - Fitness bands
 - Smart watches
 - Water or gas meters
 - Portable medical devices
 - Battery-operated smart IoT devices
- FEATURES
- High efficiency:
 - 84% at light load of 10µA
 - 97% peak efficiency at full load
 - Automatic and selectable forced bypass power-saving mode
 - Adjustable output-voltage range: 1.8V to 5.375V in 25mV increments
 - 500mA maximum output current
 - Only requires three external components: one inductor, and input and output capacitors
 - Protection functions:
 - Over-current
 - Short-circuit
 - Over-temperature

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EVPAW series: Laser-welded nylon overlay

IP67-rated tactile switches for reliable smart wearable devices

Panasonic Panasonic supplies a series of Light Touch switches for wearable and personal electronic devices which can maintain high operating performance over a long lifetime in the presence of sweat, condensation and other sources of moisture and contamination. The IP67-rated EVPAW series switches are therefore ideal for use in smart watches, wireless earphones and other devices which are worn for long periods of time and in harsh operating conditions.

An electro-mechanical switch, the EVPAW gives direct tactile feedback to the user, and can withstand abusive operating events such as accidental knocks and bumps, as well as exposure to sweat. Many wearable devices, whether in the user's hands, on their feet or on their heads, are exposed to sweat, which contains salt. When wearing a Bluetooth® wireless headset, for instance, during a workout at the gym, sweat will drip down the cable into the mechanism which operates the volume control and the microphone. If this mechanism is not waterproof as specified by an IP67 rating, sweat will get into the switch.

When dry, the salt from the sweat remains inside the device and can cause the switch to malfunction. The same applies to water, damp, moisture and dust penetration. To withstand these harsh operating conditions, the housing of the switch requires an IP67 protection rating. To make the EVPAW switches, Panasonic uses a patented laser-welding process in which the switch is sealed with a thin nylon layer applied over the switch actuator. Superior to adhesively bonded and short-lived silicone membranes, the EVPAW's nylon sealing safeguards the haptics of the switch and protects it from developing any sign of wear.

Part Number	Operating Force	Minimum Lifetime
EVPAWBD4A	1.6N	500,000 cycles
EVPAWCD4A	2.4N	500,000 cycles
EVPAWD4A	3.3N	300,000 cycles



- APPLICATIONS
- Mobile phones
 - Portable audio players
 - Wearable devices
 - Portable electronic devices
- FEATURES
- External dimensions: 3.0mm x 2.0mm, height 0.6mm
 - Push-plate actuator
 - 10ms maximum bounce time
 - 500mΩ maximum contact resistance
 - Operating-temperature range: -40°C to 85°C

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- 1 Concept**
Define • Create • Develop
- 2 Design**
Engineer • Refine • Document
- 3 Prototype**
Prove • Iterate • Learn
- 4 Manufacture**
Tool • Debug • Support



Engineering Tomorrow's Ideas

Integrated dual-output regulator operates from universal mains input

ON Semiconductor® **ON**

The switching regulator stage, which includes a 670V-rated MOSFET, steps the mains input down to a 16V output, adjustable by a resistor divider on the Feedback pin.



NCP10970: Low standby current for use in battery-powered devices

The NCP10970 from ON Semiconductor combines a switching buck converter, a Low Drop-out (LDO) linear regulator and a comparator in a single chip to provide dual outputs of 16V and 3.3V or 5.0V from a universal mains input.

This output is protected against short-circuits. Internal circuitry which prevents the converter from operating in continuous conduction mode improves the circuit's resistance to current

surges, improves efficiency and reduces EMI.

The integrated linear regulator provides either a 3.3V or 5.0V low-noise output, depending on which option is chosen. Operating from a raw 16V DC voltage supplied by the high-voltage switching regulator, high efficiency is maintained while drawing low quiescent current.

In no- or light-load conditions, the NCP10970 goes into skip-cycle mode for low standby power consumption.



APPLICATIONS

- Smart lighting
- White goods
- IoT devices
- Metering

FEATURES

- Input-voltage range: 30V to 440V AC
- High-voltage start-up current source
- Fixed-frequency discontinuous current-mode control scheme
- Demagnetization detection
- 4ms soft-start
- Thermal shut-down protection

FTM DEVELOPMENT BOARD

The NCP10970AGEVB is a high-efficiency, non-isolated buck converter circuit which complies with the CoC5 Tier 2 specifications and has low EMI emissions.

Orderable Part Number: NCP10970AGEVB

Available at FutureElectronics.com

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Extended choice of medical-qualified sounders includes new 100dB loudspeaker

MALLORY

Mallory Sound Products has extended its line of IEC 60601-1-8 qualified medical sounders, introducing new, louder alarms, and compact transducers which offer power savings in battery-powered and portable medical equipment.

Mallory's medical alarms are recognized by UL and CUL for compliance with all the requirements of the IEC60601-1-8 standard.



Mallory medical sounders: Choice of tones and standard alarms

They may easily be integrated into medical electronic system designs.

For medical applications requiring a high sound level such as in operating theaters, Mallory's 45mm-diameter SBS series speaker models are ideal: they produce 100dB at a distance of 0.1m from the speaker, and operate from a voltage between 9V and 12V. They are available with or without circuitry.

Mallory's 45mm-diameter SBT series power-saving transducer models are suitable for battery-powered applications. They are also available with or without circuitry.

Mallory has added over 150 new part numbers to the miniature 23mm MSS series. The MSS series includes sounders which can produce three tones.



APPLICATIONS

- Medical equipment

FEATURES

- MSS5G: three priority sounds, low, medium and high
- MSS5GLHCT: three different sounds, low and high with a continuous tone option
- MSS5GLMCT: three different sounds, low and medium with a continuous tone option
- MSS5GMHCT: three different sounds, medium and high with a continuous tone option
- MSS5GL: one tone type, low priority
- MSS5GM: one tone type, medium priority
- MSS5GH: one tone type, high priority

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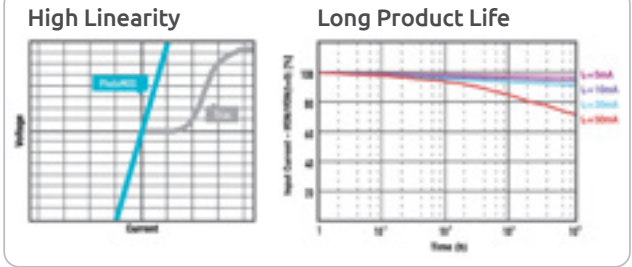
Panasonic

PhotoMOS® Optically Isolated Solid-state Relays

Panasonic's patented PhotoMOS® relays are optically isolated MOSFET relays. The input circuit has an LED which when activated transmits light to a series of photocells that, in turn, charges a pair of MOSFETs on the output circuit.

PhotoMOS technology produces solid-state relays which offer superior operating characteristics:

- Long life
- Low power consumption
- No contact wear
- Fast switching life
- No arcing
- No bounce
- No noise
- Small size



Featured Panasonic PhotoMOS relay range

Part Number	Package	Load Voltage (V)	Load Current (A)	On-Resistance Typ. (Ω)	Output Capacitance Typ. (pF)	Turn Off/On Time Typ. (mS)	Leakage Current Max. (nA)
RF Low On-resistance Type							
AQY2C1R6P	TSON	30	0.75	0.2	40	0.12 / 0.1	10
AQY2C1R2P	TSON	40	0.3	0.8	14.5	0.06 / 0.06	10
AQY2C2R2P	TSON	60	0.3	0.9	27	0.08 / 0.1	10
AQY221R6T	VSSOP	30	0.8	0.18	37.5	0.1 / 0.06	10
AQY221R2T	VSSOP	40	0.25	0.8	14	0.1 / 0.06	10
AQY222R2T	VSSOP	60	0.4	0.8	27	0.12 / 0.08	10
AQY221R2M	SON	40	0.25	0.8	14	0.2 / 0.04	10
AQY221R6V	SSOP	30	1.0	0.18	37.5	0.2 / 0.07	10
AQY221R2V	SSOP	40	0.25	0.75	12.5	0.1 / 0.08	10
AQY221R4V	SSOP	40	0.5	0.55	24	0.25 / 0.08	10
AQY222R2V	SSOP	60	0.4	0.8	27	0.15 / 0.08	10
AQY221R2S	SOP4	40	0.25	0.8	13	0.1 / 0.06	10
AQY222R1S	SOP4	60	0.5	0.8	24.5	0.15 / 0.06	10
AQY225R1S	SOP4	80	0.35	0.8	37.5	0.25 / 0.08	10
AQS221R2S	SOP16	40	0.16	0.8	13	0.15 / 0.06	10
RF Low Count Type							
AQY2C1R3P	TSON	40	0.1	10.5	1.2	0.01 / 0.02	10
AQY2C5R3P	TSON	100	0.12	9.0	5.8	0.03 / 0.04	10
AQY221N5T	VSSOP	20	0.18	2.8	1.1	0.02 / 0.01	10
AQY221N3T	VSSOP	25	0.15	5.5	1.1	0.01 / 0.03	10
AQY221N2T	VSSOP	40	0.12	9.5	1.1	0.01 / 0.03	10
AQY225R3T	VSSOP	100	0.12	8.8	5.8	0.04 / 0.05	10
AQY221N2M	SON	40	0.12	9.5	1.1	0.02 / 0.02	10
AQY221N3M	SON	25	0.15	5.5	1.1	0.02 / 0.02	10
AQY221N5V	SSOP	20	0.18	2.8	1.1	0.02 / 0.01	10
AQY221N3V	SSOP	25	0.15	5.5	1.0	0.02 / 0.02	10
AQY221N2V	SSOP	40	0.12	9.5	1.0	0.02 / 0.02	10
AQY225R2V	SSOP	80	0.12	10.5	4.5	0.05 / 0.05	10
AQY225R3V	SSOP	100	0.12	8.8	5.8	0.05 / 0.05	10
AQY221N2S	SOP4	40	0.12	9.5	1.0	0.03 / 0.03	10
AQY225R2S	SOP4	80	0.15	10.5	4.5	0.05 / 0.05	10
AQS221N2S	SOP16	40	0.06	9.5	1.0	0.03 / 0.03	10

Silicon Germanium (SiGe) rectifiers offer superior efficiency and thermal stability

nexperia

Silicon Germanium (SiGe) rectifiers combine the efficiency of silicon Schottky rectifiers with the thermal stability of Fast Recovery rectifiers, enabling engineers to optimize 100V to 200V power designs for high efficiency.

SiGe rectifiers now available from Nexperia are intended for use in applications in vehicles, servers and communications infrastructure. By offering an extended safe-operating area with no thermal runaway up to 175°C, these AEC-Q101 qualified SiGe rectifiers are particularly suitable for use in applications exposed to high ambient temperatures.

When designing rectifier circuits in the 100V to 200V range previously, engineers had to compromise between efficiency and operating temperature. While Schottky rectifiers offer very high efficiency, they suffer from thermal runaway above a certain temperature threshold. This means that use is limited in power circuits in automotive Electronic Control Units (ECUs) or fuel-injection systems for example, which routinely operate in temperatures above 150°C.

The alternative is to use a Fast Recovery rectifier. These are very thermally stable, but they have a very high forward voltage, and this compromises efficiency.

SiGe and the ideal rectifier performance

The characteristics of SiGe technology include a smaller bandgap, a faster switching frequency and higher intrinsic charge-carrier density than silicon. These features confer an advantage in high-frequency switching behavior: this is why SiGe devices are employed in radio-frequency transistors. Before now, SiGe diodes have only been discussed theoretically in academic literature, and not available for practical implementation.

Nexperia has been developing SiGe rectifier technology in recent years, and already has several patents for the process which address the apparently conflicting demands for high efficiency and high-temperature operation.

Figure 1 shows a simplified diagram of the internal structure of Nexperia's new SiGe rectifiers. To enhance performance, the rectifiers are housed in two-pin Clip-bonded FlatPower (CFP) packages (CFP3 and CFP5), which offer excellent thermal dissipation. This package design is pin-compatible with that of Schottky and Fast Recovery rectifiers.

As Figure 2 shows, the new devices maintain high thermal stability, extending the Safe Operating Area, in this example from 140°C, the temperature at which Schottky rectifiers begin thermal runaway. The SiGe rectifiers remain stable up to and beyond 175°C, the specified limit of the CFP package. Thermal runaway occurs when the reverse power generated within the chip exceeds the power which can be dissipated by the package. At this point the increase in leakage current becomes super-exponential.

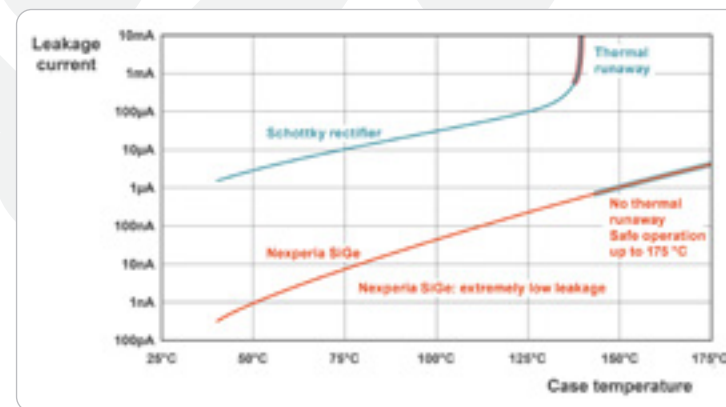


Fig. 2: Leakage current vs case temperature for a Schottky and a SiGe rectifier

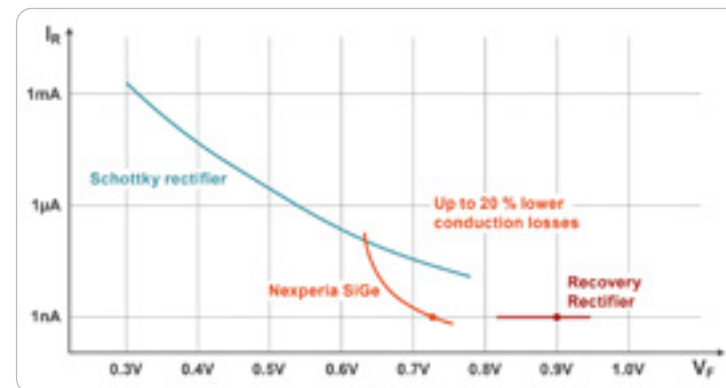


Fig. 3: Trade-off in forward voltage vs. leakage current for Schottky, SiGe, and Fast Recovery rectifiers. The SiGe rectifier shows around two orders of magnitude lower leakage current than a Schottky rectifier, and around 20% lower forward voltage drop than a Fast Recovery rectifier.

As Figure 3 shows, a Fast Recovery rectifier typically has a forward voltage of about 0.9V. Nexperia's first SiGe diode, by contrast, has low leakage current of 1nA, which, as the curve shows, equates to a forward voltage of around 0.75V, some 150mV better than the Fast Recovery rectifier.

The result is a reduction in conduction losses of around 20%. How this translates into efficiency is dependent on multiple factors, most importantly the duty cycle of the application.

As a rough estimate, an improvement in efficiency of 5-10% could be expected with the same thermal stability as the best Fast Recovery diodes.

SiGe advantages in high-temperature switching applications

In addition to these benefits, SiGe rectifiers show improved switching performance in comparison to Schottky rectifiers, for example in a 48V/12V DC-DC converter. The SiGe rectifier has a lower reverse-recovery charge and lower reverse-recovery current than a comparable Schottky rectifier, resulting in lower switching losses, in combination with a lower snappiness.

These benefits directly improve the efficiency of the DC-DC converter, as shown in Figure 4. At high frequencies, the switching losses become a major contributor to overall losses: here, the SiGe rectifier is more efficient than the Schottky rectifier.

In summary, SiGe rectifiers are a suitable choice for switch-mode power supplies even when operating in high-temperature environments. They combine the high efficiency of a Schottky rectifier with the thermal stability and safe operation of a Fast Recovery rectifier.

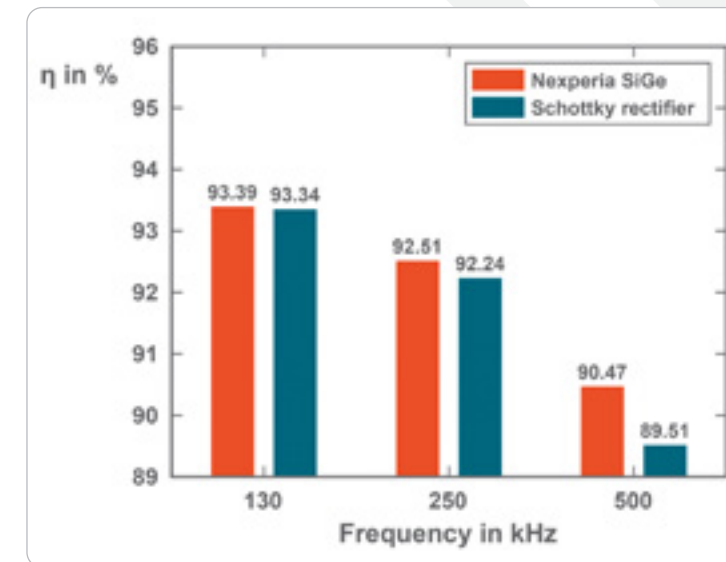


Fig. 4: Efficiency of a 48V/12V DC-DC converter at switching frequencies between 130kHz and 500kHz. A 3A SiGe rectifier is compared to a 3A Schottky rectifier. The increased efficiency of the SiGe rectifier at high frequencies is because of lower switching losses.

1A/2A/3A SiGe rectifiers in space-saving CFP packages

Nexperia has released a new range of Silicon Germanium (SiGe) rectifiers featuring 120V, 150V and 200V reverse-voltage ratings.

The new 1A to 3A SiGe rectifiers are particularly suitable for automotive applications that operate at high temperature, such as LED lighting, engine control units or fuel-injection systems. Design engineers using these low-leakage devices can now rely on an extended safe-operating area with no thermal runaway up to 175°C. At the same time, the design can be optimized for power efficiency, which is not possible with the Fast Recovery rectifiers commonly used in high-temperature designs.

Compared to Fast Recovery rectifiers, Nexperia's SiGe rectifiers offer conduction losses which are lower by some 10% to 20% thanks to the low forward voltage. The devices' low reverse-recovery charge results in low switching losses.

The PMEG120Gx, PMEG150Gx and PMEG200Gx SiGe devices are housed in compact, thermally-efficient CFP3 and CFP5 packages.

An extension of the portfolio to higher currents up to 15A is planned for 2021.

Features:

- Maximum forward-current ratings: 1A, 2A or 3A
- 1nA typical leakage current
- Fast and smooth switching
- Low parasitic capacitance
- AEC-Q101 qualified

Applications:

- Automotive systems including:
 - LED lighting
 - Engine control units
- 5G base stations
- Communications infrastructure
- Server power supplies

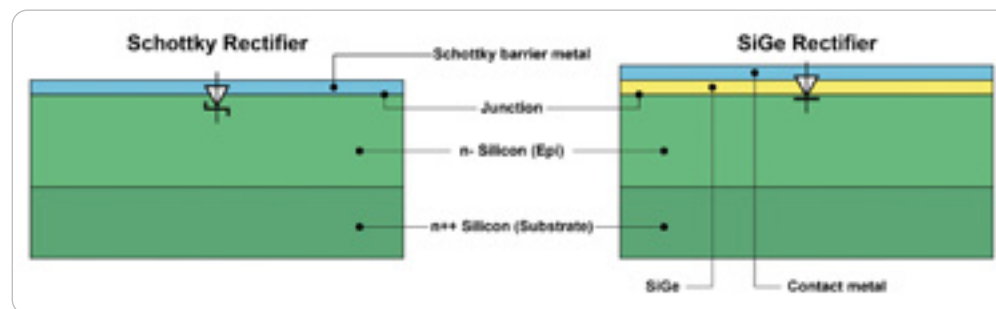


Fig. 1: Structural comparison of a Schottky and SiGe rectifier

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WIN AN INFINEON EVALUATION BOARD

Infineon is offering a free EVAL-1EDC20H12AH-SiC evaluation board to one lucky reader. All enquiries to this article will be entered into a prize draw. Contact your local Future Electronics representative for more details.



SiC MOSFET and gate driver evaluation board demonstrates high-efficiency half-bridge power circuit

Infineon Technologies has introduced an evaluation board implementing a half-bridge driver circuit which demonstrates the superior efficiency, thermal, and high-frequency switching characteristics of Silicon Carbide (SiC) semiconductor technology.

The EVAL-1EDC20H12AH-SiC evaluation board features Infineon's 1EDC20H12AH EiceDRIVER™ gate driver IC and the 1,200V IMZ120R030M1 CoolSiC™ MOSFET. The EiceDRIVER provides 2,500V of isolation, making it particularly suitable for use in high-voltage applications such as the power supplies in electric vehicle chargers, and in industrial motor drives.

The board contains two gate drivers driving two SiC MOSFET switches in a half-bridge configuration. An additional gate driver is used to transfer over-current information through the isolation barrier at the high-voltage power stage to the low-voltage input stage. A DC-DC converter also provides galvanically isolated supply voltages to each of the MOSFET driver stages.

The board's use of SiC MOSFET technology provides valuable benefits to manufacturers of advanced power systems, including:

- Very high efficiency
- Reduced cooling effort
- Higher-frequency operation
- Increased power density
- Reduced system complexity

The board includes supporting circuits for functions such as voltage regulation and DC-DC conversion which make it simple for design engineers to start using it quickly in the laboratory and to evaluate its functions in an application scenario.



APPLICATIONS

- Solar energy systems
- EV charging stations
- Uninterruptible power supplies
- Telecoms and data center power supplies
- Motor drives

FEATURES (IMZ120R030M1):

- Best-in-class switching and conduction losses
- >4V gate threshold voltage
- 0V turn-off gate voltage for easy and simple gate driving
- Wide gate-source voltage range
- Robust and low-loss body diode rated for hard commutation
- Temperature-independent turn-off switching losses

FTM DEVELOPMENT BOARD

Orderable Part Number: EVAL-1EDC20H12AH-SiC
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Discrete 1,200V SiC MOSFET combines low losses and high reliability

The IMZ120R030M1 1,200V CoolSiC™ MOSFET in a TO247-3 package builds on Infineon's state-of-the-art trench semiconductor process which combines performance with reliability.

This Silicon Carbide (SiC) MOSFET offers various performance advantages over 1,200V-rated silicon MOSFETs.

Gate charge, just 63nC at 18V, is extremely low, as is input capacitance at 116pF. The internal commutation-proof body diode produces no reverse-recovery losses, and switching losses are low across the operating-temperature range.

CoolSiC MOSFETs are ideal for hard- and resonant-switching topologies such as power factor correction circuits, bi-directional topologies, and DC-DC converters or DC-AC inverters.

SECURITY SOLUTIONS

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The mantra of any good security engineer is: 'Security is not merely a product, but a process.' It's more than designing strong cryptography into a system; it's designing the fail-safe system such that, all security measures, including cryptography, works together.

Bruce Schneier, Security Guru

Security can no longer be an afterthought

To ensure you have the right level of security, to ensure that your products are not counterfeited, to ensure that your system is not hacked, you need to find a security solution which is designed with:

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- Secure MCUs with TrustZone
- Provisioning by the manufacture/certificate authority
- Scalable deployment
- Cost and return on investment

Implementing security is not a trivial task

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Future Electronics security engineers are factory trained by major security suppliers in the industry to guide and help customers navigate to the right security solutions. We are here to assist you in understanding what type of ever-changing and growing standards for security you should be adhering to. Standards such as the industrial IEC62443, CC EAL#+, government FIPS, TPM versions, RSA, or even utilizing OWASP for best practices.



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Robust digital isolator supports high-speed communication at up to 100Mbps/s

ON Semiconductor®

ON

The NCID9211 from ON Semiconductor is a high-speed, dual-channel isolator which enables digital signals to be transferred between systems without exposing them to conducting ground loops or hazardous voltages.

Supporting full-duplex, bi-directional communication, the NCID9211 is based on ON Semiconductor's patented galvanic isolation technology, which uses an off-chip capacitor. It is the only digital isolator to provide insulation reliability which matches that of an optocoupler. The NCID9211's thick ceramic substrate yields capacitors which are around 25 times thicker than thin-film on-chip capacitors and coreless transformers. This gives a Distance Through Insulation (DTI) greater than 0.5mm - similar to the typical DTI of an optocoupler. This DTI guarantees working voltages up to 1,500V without relying on the dielectric insulation material.

At the same time, the isolator provides outstanding electrical performance, including a maximum propagation delay of 25ns and maximum pulse distortion of 10ns. This enables the regulator to support a data transfer rate up to 100Mbps/s. A related part, the NCIV9211, has AEC-Q100 qualification pending.



NCID9211: Insulation reliability matches that of an optocoupler

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APPLICATIONS

- Power supplies
- Industrial control systems
- Data acquisition equipment
- Fieldbus communications

FEATURES

- 2kV peak insulation
- 8mm creepage and clearance distance
- Supply-voltage range: 2.5V to 5.5V
- 100kV/μs minimum common-mode rejection
- Safety and regulatory approvals pending:
 - UL1577 recognition
 - DIN VDE V 0884-11
- Operating-temperature range: -40°C to 125°C

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Ready-to-use industrial Ethernet module includes certified hardware and software



BIG IDEAS FOR EVERY SPACE

Renesas has introduced a complete, ready-to-use Ethernet module for use in industrial applications which is based on its R-IN32M3 multi-protocol communication IC.

Both the module hardware and the Ethernet protocol software which Renesas supplies are certified for compliance with the Ethernet standard for interoperability.



R-IN32M3 module: SPI control link to host processor

This dramatically reduces the total cost of ownership as well as lifting barriers to the use of new network technology in industrial equipment.

The module supports multiple real-time data networking protocols including PROFINET RT, EtherNet/IP™ and EtherCAT®. It includes Ethernet ports supporting data transfers at rates of 10Mbps/s or 100Mbps/s with auto-negotiation. It also features a two-port Ethernet switch for bus and ring network topologies. Control and configuration are provided via a high-speed serial peripheral interface and power pins to connect the module to a host processor.

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APPLICATIONS

- Industrial automation equipment
- Protocol conversion gateways
- Portable industrial devices
- Industrial human-machine interfaces

FEATURES

- No additional license fees payable
- Source code for application examples
- Extensive tool chain supports development and test process

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Non-volatile MRAM products offer high-speed alternative to battery-backed SRAM





BIG IDEAS FOR EVERY SPACE

Renesas has extended its range of Magnetoresistive Random-Access Memory (MRAM) products with the M3000 and M1000 series, offering non-volatile memory densities of 4Mbits, 8Mbits or 16Mbits.

Renesas fabricates the MRAM devices with a new, proprietary technology called perpendicular magnetic-tunnel-junction Spin-Transfer Torque (STT), achieving best-in-class non-volatile memory performance including long data retention and fast Read and Write speeds. The Renesas MRAM products have configurable single, dual or quad serial peripheral interfaces which can operate in single or double data-rate modes at up to 108MHz. MRAM offers various performance advantages over other non-volatile memory technologies such as Flash. These include high memory density, long endurance, and low-voltage operation.

MRAM is ideal as a replacement for battery-backed SRAM: while SRAM also offers high Read and Write speeds, the non-volatile nature of MRAM means that it needs no dedicated battery power supply in case of system power failure. The elimination of the back-up battery in MRAM-based data logging systems saves not only the cost of the battery itself, but also the pain of replacement, implementation of power-management firmware, and space. Ferroelectric RAM (FRAM) is also often considered as a replacement for battery-backed SRAM, and offers similar performance to MRAM. But Renesas' MRAM devices offer higher density and longer endurance than FRAM products.

Part Number	Density (kbytes)	I/O Voltage	I/O Frequency
M1004204	4,096	1.8V	54MHz, 108MHz
M1008204	8,192	1.8V	54MHz, 108MHz
M1016204	16,384	1.8V	54MHz, 108MHz
M3004204	4,096	3V	54MHz, 108MHz
M3008204	8,192	3V	54MHz, 108MHz
M3016204	16,384	3V	54MHz, 108MHz

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APPLICATIONS

- Industrial control and monitoring
- Multi-function printers
- Robotics
- Data switches and routers
- Hearing aids
- Solid-State Drives (SSDs) for data storage

FEATURES

- Low active Write and Read current
- Supply-voltage range: 1.71V to 3.6V
- Operating-temperature range: -40°C to 105°C

FTM DEVELOPMENT BOARD

The M3016 evaluation kit contains a 16Mbit MRAM, and features an Arduino host board and terminal emulator software which communicate with a PC via a USB interface.

Test programs supplied with the kit enable the user to quickly evaluate the functionality of the MRAM device.

Orderable Part Number: M3016-EVK

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The role of ESD protection in the all-IP car

How Ethernet and new architectures require new ESD protection concepts to provide the highest system reliability

nexperia

It was Henry Ford who said, ‘You can have it in any color you want, as long as it is black.’ This statement might have been valid decades ago, but customer expectations have grown dramatically, and now the modern automotive world is currently dominated by three major trends: electrification, autonomous driving, and connectivity. While the first has a massive impact on the power train and the high-voltage part of the wiring harness, the last two are driving a paradigm change in the way Electronic Control Units (ECUs) communicate in the car.

Trends and concepts drawn from consumer electronics, communications infrastructure and the IoT are being adopted in the vehicle. Autonomous driving and in-vehicle connectivity in particular are creating demand for higher data-transfer rates and a zonal architecture.

The topology of today’s in-vehicle networks can only be understood by reference to signaling technologies used in the past. The first electrical control interfaces in vehicles connected the controller and actuator via a single wire. As demand for functionality increased, bus networks were introduced. The buses connected the control units which managed discrete functional blocks, such as the power train or body control.

This scheme can still be found in today’s cars, even though it has expanded due to the increased demand for bandwidth and interconnections. The implementation of physically separate buses to meet security requirements makes the topology even more complex.

If a designer were to devise an in-vehicle network from scratch today, the approach would be different. Modern techniques, such as the decoupling of physical and software addresses, plug-and-play configurability, and end-to-end encryption would be readily available. Today’s in-vehicle networks do not provide these features, however, and retrofitting is expensive and does not work properly in many cases.

In contrast to the old way of connecting ECUs which talk to each other directly, a zonal architecture aims to form a network by which, in principle, any ECU can talk to any other. To do so, every ECU is connected to a domain or zone controller directly via a short CAN, LIN or 10BASE-T1S interface. The domain or zone controllers are connected using a high-speed backbone network technology such as 1000BASE-T1, as shown in Figure 1.

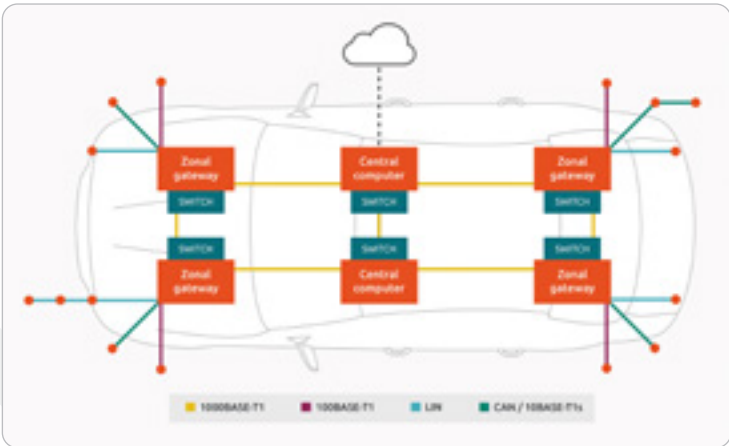


Fig. 1: Modern in-vehicle network with zonal architecture and Ethernet as the backbone

Software makes the system very versatile: virtual CAN/LIN networks can be implemented, so that legacy ECUs can operate as though via an old-fashioned CAN/LIN-only topology. As every ECU has a dynamic Internet Protocol (IP) address, plug-and-play operation as well as reconfigurability, for instance supporting over-the-air updating, are possible. When based on software, secure sub-networks can be formed to ensure compliance with safety standards in safety-critical applications and to protect sensitive data.

Automotive Ethernet is the system of choice for such a topology, as it inherently provides the desired flexibility. Furthermore, it is easy for engineers to implement, as it is the standard technology in today’s communications infrastructure.

The different speed classes suit the three different stages of the zonal architecture: 1000BASE-T1 and multi-gigabit Ethernet for the connection of the zone controllers; 100BASE-T1 for the direct connection of ECUs to the zone controller; and 10BASE-T1S to connect ECUs with a limited demand for bandwidth to a zone controller.

This enables the concept ‘all-IP car’ connected solely via automotive Ethernet. The expert community is split on the question of whether this idea will be realized in future, or even whether it is desirable. The general consensus is that legacy protocols such as LIN, CAN and FlexRay will remain in zonal architectures for cost and legacy reasons. The exception to the zonal architecture, according to the experts, can be found in the high-speed connection of driver-assistance system sensors to the respective control units. Here, no flexibility is required, and a mostly unidirectional, high-bandwidth data stream needs to be transmitted. The technology of choice, SerDes interfaces, fulfills this need.

Faced with the mega-trends discussed above, hardware engineers must handle a specific problem in network communications design: ESD robustness. As the feature size of ICs shrinks, engineers can no longer sacrifice design space for internal ESD protection. This means that new concepts of external ESD protection come into play. This is necessary, since the robustness of device-level ESD protection might be sufficient, but at the system level the protection is inadequate. In the light of the security threats prevalent in highly connected architectures, and especially when implementing autonomous driving technologies, the danger posed by potential system failures caused by ESD events is severe and must be prevented.

In the system implementation specification for 100BASE-T1, the OPEN Alliance proposes two possible external ESD protection devices. As shown in Figure 2, one can be placed at the connector (ESD_1) and one at the PHY (ESD_2). The specification allows the use of none, one or both devices to achieve the desired ESD robustness.

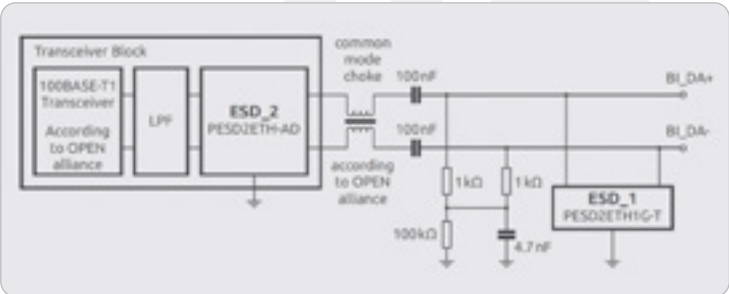


Fig. 2: Interface topology for 100BASE-T1 according to the OPEN Alliance. ESD protection is located at the connector and as part of the transceiver block.

External ESD protection at the PHY is considered a part of the PHY from the point of view of the Ethernet specification. Hence the PHY in combination with external protection needs to pass all requirements that apply to the PHY alone. The protection at the connector must comply with the OPEN Alliance specification for external ESD protection devices. Besides having maximum capacitance of 3pF, the ESD protection device should feature a minimum trigger voltage of 100V, due to the placement at the connector.

From a system perspective, external ESD protection at the connector is superior, and offers the best way to design a robust interface. This can be observed when using an EMI scanner during an ESD event, as shown in Figure 3: here, the color scale reflects the current amplitude from blue (0A) to red (maximum current). Three cases of ESD protection placements are compared.

Scenario 1 shows current amplitude during an ESD event for the Medium-Dependent Interface (MDI) without external ESD protection: high current flows throughout the PCB from the connector to the PHY.

In scenario 2, an ESD protection device is positioned between the Common-Mode Choke (CMC) and the PHY. Though the current at the PHY is lower, high current still flows through the PCB, weakening the passive and active components.

In scenario 3, the ESD protection is placed at the connector before the CMC and PHY as recommended. Very little electrical stress can be observed throughout the MDI, providing the best system-level robustness and reliability.

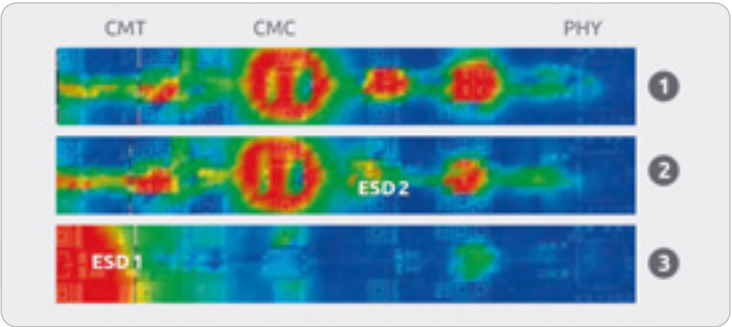


Fig. 3: Current amplitude during an ESD event for the MDI without [1] and with external ESD protection at the PHY [2] and at the connector [3]. The color scale reflects the current amplitude from blue (0A) to red (maximum current).

Technical differences between ESD protection devices can have a marked impact on the result of this measurement and thus on the ESD robustness of the interface. The interplay of the saturation characteristic of the CMC and the clamping behavior of the external ESD protection are the most important factors. Clamping needs to be as low as possible, to prevent the CMC from going into saturation. The requirements of a trigger voltage, however, and the ‘unwanted clamping’ test need to be met as well.

There are currently three main technologies which might be applicable to ESD protection: Zener diodes, advanced silicon technologies (such as silicon-controlled rectifiers, open-base transistors and other snap-back technologies), and varistors.

Considering the RF requirements of the interface, it is clear that a Zener diode is not an option; only silicon-based or varistor technology can be used. Silicon technology can make use of the snap-back effect, resulting in very low clamping voltages while meeting the other requirements of the norm. Varistors may also offer suitable RF behavior and high trigger voltages. The clamping voltage however is substantially higher. This can be seen in the Transmission Line Pulse (TLP) graph in Figure 4, together with the resulting discharge currents at 6kV. The snap-back and resulting very low clamping of the Nexperia PESD2ETH1G-T provides better protection than the varistor-based solution.

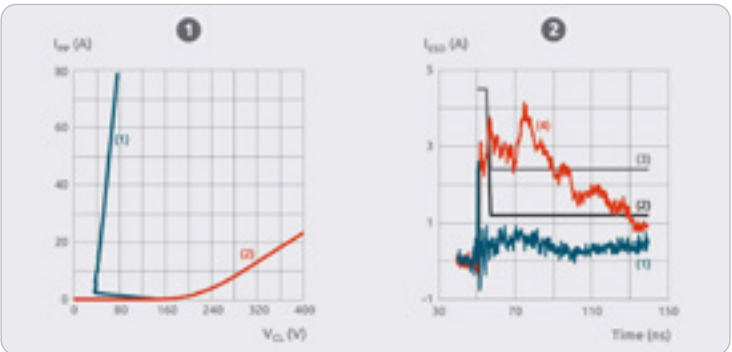


Fig. 4: TLP graph (left) of a silicon based ESD protection device, Nexperia's PESD2ETH1G-T (1) and of a varistor (2) and the corresponding ESD discharge current measurements (right)

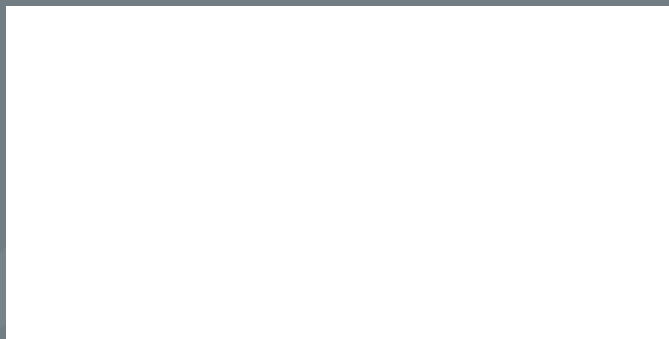
The evolution of the wiring harness in vehicles offers great opportunities for new functionality, but also confronts design engineers with new design problems. New ESD protection concepts help to achieve high system-level robustness while offering more PCB design flexibility.

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SSM SUSUMU
Thin Film Specialist and Innovator

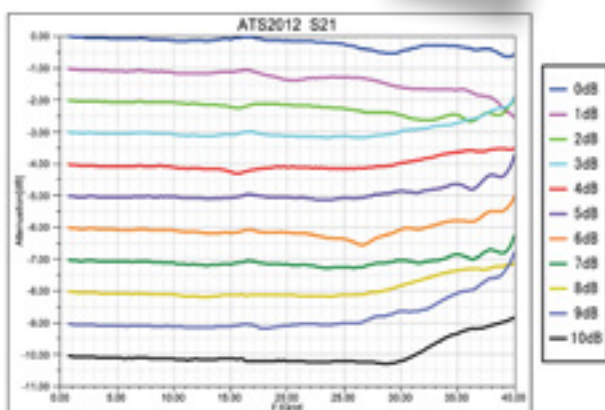
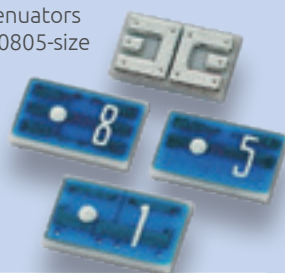
Susumu's new ATS series of chip attenuators is rated for operation up to 30GHz, making it ideal for use in high-frequency communications systems, such as 5G networks.

The development of the ATS series drew on Susumu's expertise in the design and production of innovative precision thin-film chip resistors and an attenuator is a resistor network with impedance matching. Thin film is a suitable material for high-frequency attenuators as it has no skin effect.

Susumu implemented a number of design innovations to enable the ATS series to operate at very high frequency:

- The resistive elements on top of the ceramic substrate are connected to the terminal on the bottom with through-hole vias. This shortens the distance that signals travel, thus minimizing inductance
- A thinner substrate achieves the same effect
- The trimming line is shaped specially to avoid reflections
- The ground terminals surround the signal terminal to reduce interference and crosstalk.

The ATS series attenuators are offered in the 0805-size chip package. ATS series attenuators are available with attenuation values from 0dB to 10dB, in 1dB increments.



APPLICATIONS

- Wireless communications systems and modules
- Base transmitter stations
- Avionics
- Wireless power transmitters
- Drones
- IoT devices

FEATURES

- Operating-frequency range: DC to 30GHz
- Attenuation tolerances:
 - $\pm 0.5\text{dB}$ from DC to 20GHz
 - $\pm 0.75\text{dB}$ from 20GHz to 30GHz
- Voltage standing wave ratio:
 - ≤ 1.5 from DC to 20GHz
 - ≤ 1.7 from 20GHz to 30GHz
- 50 Ω impedance
- 100mW rated power
- Operating-temperature range: -55°C to 125°C

TO BUY PRODUCTS OR DOWNLOAD DATA
FUTUREELECTRONICS.COM/RESOURCES/FTM